Hearing on Oxygenated Fuels

BEFORE

The Health and Environment Subcommittee
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Testimony of Janet Hathaway, Senior Attorney, and Dave Hawkins, Senior Attorney

on behalf of the

Natural Resources Defense Council (NRDC)

A. MTBE Contamination: America's Challenge to Better Protect Air and Water

Detection of MTBE in water provides us with convincing evidence that our methods of storing, transporting and using gasoline and other petroleum fuels must be substantially improved. MTBE and other gasoline constituents have been detected in California in surface and ground water as well as in other states. These findings make obvious what we should have known: gasoline endangers our water, and improper storage of gasoline will result in soil contamination that can then endanger ground water.

States also jeopardize water supplies when, as in California, they allow highly-polluting, very inefficient recreational vehicles on reservoirs -- and where this happens, one finds not only MTBE but benzene, a known human carcinogen, and other gasoline toxics including toluene, xylene and ethylbenzene. Throughout the country, fuel storage tanks have been located in porous soil over shallow groundwater, and over the years many of these tanks leaked fuel. In such places, MTBE as well as a long list of gasoline constituents will be found, both in soil and in groundwater.

MTBE is not the only dangerous substance in gasoline, but it has perhaps become the most notorious. Gasoline is a cocktail of known and suspected carcinogens, neurotoxins, and reproductive toxicants. Studies of workers exposed to gasoline suggest higher rates of leukemia, kidney

cancers and other cancers may be associated with exposures to gasoline or its constituents.[1] While today's science does not suggest that MTBE is among the most dangerous substances in gasoline, the fact that sensitive people detect a foul taste at concentrations of MTBE as low as a few parts per billion makes it impossible to ignore. Perhaps there is a silver lining in our inability to ignore this problem. We should ignore neither MTBE contamination nor any other of the pervasive gasoline spills and leaks endangering our environment.

If the nation responds to the evidence of gasoline contamination merely by banning MTBE, the larger environmental problem represented by thousands of leaking tanks and recurrent gasoline spills will remain. Will we simply repeat today's scenario a few years hence with a different chemical "culprit" – another ether or another gasoline constituent? That would be most unfortunate. Instead, let us use what we've learned about the dangers gasoline contamination poses to the environment to better protect air, water and soil.

The challenge is to preserve the air quality benefits that have resulted from reformulated gasoline (RFG)-which will increase with Phase II of the federal RFG program beginning in December of this year-while taking action to improve protection of our reservoirs, ground water and surface water.

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[1] "Potential Health Effects of Gasoline and Its Constituents: A Review of Current Literature (19901997) on Toxicological Data". *Environ. Health Perspect*. 1998 Mar; 106(3):115-125; McKee RH, Plutnick RT Exxon Biomedical Sciences, Inc., East Millstone, New Jersey 08875-2350, "Carcinogenic potential of gasoline and diesel engine oils," *Fundam. Appl. Toxicol* .1989 Oct;13(3):545-553; Raaschou-Nielsen O, Lohse C, Thomsen BL, Skov H, Olsen JH Division for Cancer Epidemiology, Danish Cancer Society, Copenhagen, Denmark. ole@cancer.dk, "Ambient air levels and the exposure of children to benzene, toluene, and xylenes in Denmark," *Environ Res*, 1997 Nov; 75(2):149-159; Infante PF Health Standards Program, Occupational Safety and Health Administration, Washington, DC 20210, "State of the science on the carcinogenicity of gasoline with particular reference to cohort mortality study results," *Environ Health Perspect* 1993 Dec;101 Suppl 6:105-109; Hadnagy W, Seemayer NH Medizinisches Institut fur Umwelthygiene, Universitat Dusseldorf, FRG.; "Genotoxicity of particulate emissions from gasoline-powered engines evaluated by short-term bioassays." *Exp Pathol* 1989;37(1-4):43-50; *Environ Health Perspect* 1985 Oct;62:303-312 "Epidemiologic evidence for an association between gasoline and kidney cancer." Enterline PE, Viren J; Lynge E, Andersen A, Nilsson R, Barlow L, Pukkala E, Nordlinder R, Boffetta P, Grandjean P, Heikkila P, Horte LG, Jakobsson R, Lundberg I, Moen B, Partanen T, Riise T Danish Cancer Society, Copenhagen, Denmark., "Risk of cancer and exposure to gasoline vapors," *Am J Epidemiol* 1997 Mar 1;145(5):449-458; Hotz P, Lauwerys RR Unit of Industrial Toxicology and Occupational Medicine, Catholic University of Louvain, Brussels, Belgium, "Hematopoietic and lymphatic malignancies in vehicle mechanics," *Crit Rev Toxicol* 1997 Sep;27(5):443-494; Enterline PE Graduate School of Public Health, University of Pittsburgh, PA 15261, "Review of new evidence regarding the relationship of gasoline exposure to kidney cancer and leukemia."; *Environ Health Perspect* 1993 Dec;101 Suppl 6:101-103; Caprino L, Togna GI, Institute of Medical Pharmacology, University of Rome "La Sapienza," Rome, Italy, *Potential Health Effects of Gasoline and Its Constituents: A Review of Current Literature (19901997) on Toxicological Data* ; Guldberg PH Tech Environmental, Inc., Waltham, MA 02154. "Gasoline and vapor exposures in service station and leaking underground storage tank scenarios.", *J Expo Anal Environ Epidemiol* 1992 Jan;2(1):97-107.

Various bills have been introduced in this and the previous Congress to address concerns about contamination of groundwater. NRDC supports giving states flexibility to limit or even eliminate their oxygenate use **so long as the states preserve the air quality benefits of reformulated gasoline** (RFG). Different legislative approaches could achieve that end.

One approach would simply eliminate the minimum oxygen content requirement currently in the Clean Air Act. NRDC would support such legislation if it includes an express requirement to preserve all existing and anticipated RFG air quality benefits. We understand that Senator Chafee is proposing legislation which has that objective. The Clean Air Act and regulatory performance standards mandating reductions of air toxics and ozone precursors, however, would remain in place. With some needed drafting changes to clarify the critical requirement to preserve all current and anticipated RFG benefits, the Chafee bill would be a positive step.

Another approach is embodied in legislation before this committee. H.R. 11 (introduced by Mr. Bilbray of California, with a companion Senate bill introduced by Senator Feinstein) allows any state which adopts especially stringent vehicle standards because of serious air pollution and which EPA determines to have a reformulated fuels program at least as effective as the federal program ("achieving equivalent or greater emissions reductions") to apply state fuel standards instead of the federal program specifications. This approach would effectively eliminate the specification of oxygen content but would require equivalent reductions of toxic emissions and ozone precursors. This approach also is meritorious in providing flexibility to states to ensure air quality protection without requiring a specified percentage of oxygenates in fuels.

Both of these approaches are good first steps toward improving fuels in ways that better protect our water supplies.

But it is important that such bills be accompanied by two additional initiatives: concerted efforts to identify funds for remedial action at sites contaminated by fuel leaks and spills; and a revamping of programs to minimize future leaks from tanks and reservoir contamination. If we have learned from the legacy of gasoline spills and leaks, we will establish a coordinated program of better fuel storage regulation, clear liability for those owning or operating leaking tanks or pipelines, better enforcement against those responsible for fuel spills and leaking tanks, and better financial resources to address abandoned sites.

Elimination of the minimum oxygen requirement for reformulated gasoline unquestionably moves fuel policy in the proper direction. While this alone will not eliminate spills and leaks of fuels and oxygenates, it is a necessary prerequisite to state, regional, and national action to reduce oxygenates in gasoline and to reduce threats to water.

B. Congressional Action Should Not Reduce Air Quality Benefits of Reformulated Gasoline.

1. Air Quality Benefits of RFG and RFG Phase II Should be Preserved.

Absolutely fundamental to NRDC is the preservation of air quality benefits achieved through reformulated fuels. These benefits cannot be allowed to decline in any manner. If the mandate for 2% by weight oxygen in gasoline is eliminated, fuels are still required to meet the performance standards for RFG established by EPA in 1994.[2] This does ensure that certain fuel parameters specified in the Clean Air Act will not be violated, but these specifications do not provide sufficient detail to ensure all air quality benefits will be retained. Without further regulatory action, reductions in oxygenates could cause some regions to experience increases of olefins in gasoline, which in turn would increase atmospheric levels of 1,3-butadiene, a potent carcinogen. EPA should commence rule-making to ensure that the nation's fuels will reduce aromatics, toxics, and volatile organics, as required by the Clean Air Act, without increases in nitrogen oxides, and without increases of other toxics in the new fuel. EPA must also ensure that areas with conventional (i.e., non-reformulated) gasoline will not suffer a decline in fuel quality and increasing air pollution as refiners shift cleaner fuel to the RFG areas.

Some confusing news reports have suggested that oxygenates have no air quality benefits. This is not true. While air quality has improved from the use of oxygenates, these benefits need not be forfeited from future formulations using lower concentrations of oxygenates or even no oygenates at all. However, this does not mean that making a transition to low- or no-oxygenate fuel can be immediate or without cost.

A fair part of the confusion on this issue has resulted from a report from University of California researchers stating that fuels could provide equivalent benefits without using oxygenates.

The California legislature requested the University of California to quantify the benefits attributable to MTBE from California's reformulated, oxygenated fuel.[3] Unfortunately, this request was not one that could directly be met. On the one hand, the UC did estimate the benefit of

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[2] Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: Standards for Reformulated and Conventional Gasoline," Federal Register, February 16, 1994.

[3] Keller et al., UC MTBE Report, Executive Summary and Recommendations, *Health and Environmental Assessment of MTBE, Report to the Legislature of the State of California*, November 12, 1998, p. 11. UC MTBE Report Internet web site http:.www.tsrtp.ucdavis.edu/mtberpt.

reformulated gasoline and found it to be substantial. Ca RFG with about 11% MTBE reduced emissions of ozone precursors (volatile organic compounds and nitrogen oxides) from gasoline vehicles by about 15 percent (300 tons per day), reduced CO emissions by about 11 percent (1300 tons per day), and reduced sulfur dioxide (SO) emissions by about 80 percent (30 tons per day).[4] Ca RFG with MTBE at about 11% reduces the use of aromatics (such as benzene) in gasoline by about 25%.[5] These are enormous benefits, essential for attainment of health-protective air quality standards for ozone, CO and particulate matter. ARB analysis of air monitoring data suggest that the Ca RFG program may have reduced ozone levels in Southern California and Sacramento by 10 percent and 12 percent, respectively.[6]

But UC Berkeley report representatives noted they could not simply compare CA RFG with MTBE and CA RFG without MTBE, and attribute differences to MTBE.[7] The reason is that there is no way to remove only the oxygenates from the fuel but still meet the state's mandatory gasoline performance standards. In other words, oxygenates are an integral part of the current formulation, and one cannot simply remove oxygenates and still have a gasoline meeting the RFG standards. However, according to oil company representatives from Tosco and Chevron[8], if oxygenates are reduced or removed and other fuel parameters are changed in very precise ways, the resulting fuel may meet the stringent California RFG standards,

Oxygenates have useful qualities that induced oil companies to use them in fuels. They function in gasoline to provide octane enhancement, allow dilution and reduction of aromatics (resulting in lower toxics both from evaporation and combustion), and provide available oxygen to reduce CO formation from engines. The ethers like MTBE and ETBE, unlike ethanol, can be stored and transported with existing infrastructure and do not increase vapor pressure. Nevertheless, the oxygenates definitely pose environmental problems when they spill or leak, because they move relatively rapidly through soil and the ethers resist degradation.

The UC Report attempted to answer the confusing question, "What air quality benefits come from using MTBE?" by saying that though there are substantial air quality benefits from CA reformulated gasoline, these

[4] California Environmental Protection Agency, MTBE (Methyl tertiary butyl ether) Briefing Paper, updated September 3, 1998, p. 7-8.
[5] Oxygenated Fuels Association, "A Critical Review of the University of California's Report on the Health and Environmental Assessment of MTBE," December 1998, p. 14.
[6] California Air Resources Board, "Cleaner-Burning Gasoline: An Assessment of Its Impact on Ozone Air Quality in California," October 1997.
[7] U.C. Berkeley presentation before the U.S. EPA Blue Ribbon Panel on Oxygenates, Sacramento, CA, March 25, 1999.
[8] Tosco and Chevron presentations before the U.S. EPA Blue Ribbon Panel on Oxygenates, Sacramento, CA, March 26, 1999.

benefits are not uniquely attributable to MTBE. Although reformulated gasoline with oxygenates provided real and substantial benefits, and though MTBE is an integral part of much of the current RFG, those benefits can be obtained through other fuel formulations.

There is a danger that some people may mistakenly infer from the finding that oxygenates are not "essential" the conclusion that eliminating all oxygenates immediately and completely is without risk. That inference is not warranted. Especially for federal reformulated gasoline, with its higher aromatics, higher vapor pressure and much higher sulfur levels, taking MTBE out without establishing careful standards for the new fuel formulation could result in increased air toxics and more smog.

2. The Clean Air Act Establishes Air Quality Performance Standards for Reformulated Gasoline: Fuels Using Minimal Oxygenates Can Reduce Threats of Water Contamination.

An Auto/Oil study of 1995 and subsequent oil industry pronouncements confirm that refiners can provide large supplies of non-oxygenated fuels. In late 1997, as debate about MTBE intensified, a variety of oil industry representatives stated that they have manufactured fuels with the air quality benefits of RFG and greatly reduced levels of oxygenates.

Fortunately for the federal RFG program, the EPA's model already evaluates the air quality benefits of different formulations of RFG with specific consideration of the properties of different oxygenates which may be used. Because that model is already a number of years old and does not reflect the newest health and environmental studies, and because that model did not take into account the volatility effects that occur when different oxygenates are mixed (this "commingling" effect is especially significant when ethanol blends are mixed with non-ethanol blends), US EPA needs to further improve its model to ensure that changes in fuels, including modifying oxygenate amounts and types, do not lead to any diminution in air quality. Furthermore, it will be important for US EPA to ensure that conventional gasoline is not adversely affected by refiners' efforts to supply cleaner fuel to RFG areas.

US EPA should evaluate the need for stringent parameters ("cap limits") for individual toxics in gasoline. If this is not done before fuels are modified, the known human cancer-causing substances in gasoline fumes or tailpipe emissions, such as benzene and 1,3-butadiene, may well increase. The Clean Air Act wisely establishes performance standards to be achieved by the fuel, including limits on total toxics and aromatics. But EPA must make further careful evaluations to ensure that overall risk is not increases, even while total mass emissions of toxics may remain

stable. EPA must also consider potential trade-offs posed by different fuel formulations, such as increasing potential risks through other exposure routes, such skin absorption, as well as ensuring that the fuel meets RFG performance criteria. This evaluation must include full consideration of potential risks to water supplies and aquatic life from new fuel formulations.

EPA can, and should, prevent increases of the concentrations of toxics and known carcinogens by further restrictions on aromatics and olefin content or by specific cap limits. Acetalydehyde and formaldehyde, both carcinogens which are already present at risky levels in urban air from gasoline combustion, must be carefully limited. Hazards from fuel evaporation, combustion emissions, and the chemical transformation of these substances in the atmosphere must all be carefully considered to ensure no backsliding in environmental progress.[9]

C. Other Oxygenates Should be Studied for Health and Environmental Effects.

Federal law currently requires the use of oxygenates. Many have suggested repealing this requirement, in order to reduce oxygenate use throughout the country. This committee has legislation before it with substantially the same effect.

The United States Environmental Protection Agency warned, "It should not be inferred that the only oxygenate warranting attention is MTBE or, for that matter, that the issues identified here are necessarily unique to oxyfuels."[10] With new scientific data and practical experience, the U.S. EPA must carefully modify fuel regulations to protect the environment and human health.

As a policy matter, NRDC recommends resisting pleas that fuel constituents be mandated or that recipes of the fuel be defined by law. The risks of MTBE contamination should not be reduced in ways that simply increase other less-studied risks. To avoid a repetition of fuel contamination problems of recent years, full environmental and health

[9] While MTBE increases atmospheric levels of formaldehyde, ethanol and ethyl tertiary butyl ether (ETBE), tertiary amyl methyl ether (TAME), significantly increase acetalydehyde.

[10] Office of Research and Development, United States Environmental Protection Agency, *Oxygenates in Water: Critical Information and Research Needs*, EPA/600/R-98/048, December 1998, p. 5.

impacts of alternatives to MTBE should be evaluated before they are used in gasoline.[11]

Even if the federal minimum requirement for oxygenates were repealed, it is likely that some use of oxygenates, whether ethanol, other alcohols[12] or ethers[13], would persist. The simple reason is that these substances boost octane in gasoline. The phase-out of lead, a dangerous neurotoxin, has required refiners to find alternatives for enhancing octane levels in gasoline.[14] Without further environmental and health studies on the other oxygenates, it is impossible to know if substitution alternative oxygenates for MTBE will affect public health adversely.

1. Alternative Ethers May Not Reduce Groundwater Contamination.

Dr. John Froines and other University of California physicians and health scientists warn against assuming that MTBE is the only oxygenate posing environmental and health risks. "Introduction of these compounds [alternative ethers, including ETBE, TAME, and DIPE] as a substitute for MTBE is not advisable at this point in time given the paucity of data on their health effects."[15]

MTBE has been extensively studied for both acute and chronic effects in animals and, to some extent, in humans. Some aquatic toxicity studies have been conducted for the alternative ethers, but essentially nothing is known about chronic health and environmental impacts of alternative ethers, including ETBE and TAME.[16] "The information on the health effects and toxicology of the other substitutes, ETBE, TAME and DIPE is extremely limited."[17] What is know is that none of these oxygenates are

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[11] "Selection of an alternative to MTBE should not occur without adequate health effects and exposure assessment, and that is an important consideration in evaluating the potential efficacy of ethanol as an MTBE substitute." Froines, et al, "An Evaluation of the Scientific Peer-Reviewed Research and Literature on the Human Health Effects of MTBE, its Metabolites, Combustion Products and Substitute Compounds," *Report to the Legislature of the State of California*, Volume II, Human Health Effects, November 1998, p. 179.

[12] Other alcohols which may be used as oxygenates include methanol and tertiary butanol (TBA).

[13] Other ethers which may be used as oxygenates include ethyl tertiary butyl ether (ETBE), tertiary amyl methyl ether (TAME), tertiary amyl ethyl ether (TAEE), diisopropul ether (DIPE) and dimethyl ether (DME). Only the first two have been used in significant quantities to date.

[14] The choices for octane enhancement have been properly limited by restrictions on toxic aromatics and neurotoxic metals such as lead and manganese compounds (e.g., MMT).

[15] Froines, et al. *Report to the Legislature of the State of California*, Volume II, Human Health Effects, November 1998, pp. 179-180.

[16] US EPA has required manufacturers to study the effects of chronic exposure to ETBE and TAME. The results will not be available for at least another year. See ORD, United States Environmental Protection Agency, *Oxygenates in Water: Critical Information and Research Needs*, EPA/600/R-98/048, December 1998, p. 24.

[17] Froines, et al, "An Evaluation of the Scientific Peer-Reviewed Research and Literature on the Human Health Effects of MTBE, its Metabolites, Combustion Products and Substitute Compounds," *Report to the Legislature of the State of California*, Volume II, Human Health Effects, November 1998, p. 179.

without risk. All of the oxygenates can move swiftly through soil if spilled or leaked. There is no reason to believe other ethers would reduce toxicity relative to MTBE, and they, like MTBE, may make water unpalatable at extremely low concentrations.

2. Ethanol Use May Increase Air Toxics and Pose Additional Health Risks.

Ethanol is a familiar product, but it also poses health concerns. The UC Report on Health Effects states, "Use of ethanol would result in increased atmospheric concentrations of acetaldehyde and peroxyacetylnitrate (PAN). Acetaldehyde has been listed as a Toxic Air Contaminant in California based on evidence of carcinogenicity and while PAN has not been tested for carcinogenicity, it is genotoxic [causes genetic damage] and produces respiratory and eye irritation and may produce lung damage."[18] In a separate section these scientists reiterate, "The formation of formaldehyde, acetaldehyde and PAN in the atmosphere [from ethanol use] are matters of considerable concern and represent one of our highest recommendations for future research."[19]

Studies of high level exposures to ethanol (virtually all studies of ingestion rather than inhalation) demonstrate that ethanol increases a variety of adverse human health effects, ranging from developmental toxicity, central nervous system dysfunction, teratogenicity (birth defects), reproductive disorders and cancer[20]. Pregnant women are generally advised to avoid ethanol exposure by avoiding alcoholic beverages, because chronic ingestion is known to cause fetal alcohol syndrome, a profound birth defect including major neurological dysfunction. Some data suggest developmental toxicity even at low doses.[21] Today pregnant women can effectively avoid ethanol exposure. But if gasoline blends contain ethanol, pregnant women may find it impossible to avoid ethanol exposure through air when they refuel their vehicle. Today, no one knows if such exposures could be harmful to the developing fetus.

Before expanding the use of ethanol in gasoline, policy makers and the public should better understand the health impacts. Combustion products

[18] f Froines et al, "An Evaluation of the Scientific Peer-Reviewed Research and Literature on the Human Health Effects of MTBE, its Metabolites, Combustion Products and Substitute Compounds," Report to the Legislature of the State of California, Volume II, Human Health Effects, November 1998, p. xix.

[19] Froines et al, 1998, p. 179.

[20] Froines et al, "An Evaluation of the Scientific Peer-Reviewed Research and Literature on the Human Health Effects of MTBE, its Metabolites, Combustion Products and Substitute Compounds," *Report to the Legislature of the State of California*, Volume II, Human Health Effects, November 1998, pp. 144-153, 179., Health Effects Institute. The Potential Health Effects of Oxygenates Added to Gasoline, A Review of the Current Literature. A Special Report of the Institute's Oxygenates Evaluation Committee. April 1996.

[21] Froines, op cit. p. 150-151.

of ethanol include both formaldehyde and acetalydehyde, both known carcinogens. Likely sub-populations with special sensitivity to ethanol exposure include pregnant women and people with a specific genetic trait affecting their metabolism of ethanol.[22] This genetic trait, a trait which a majority of Asian populations share, experience much higher blood levels of acetaldehyde and an increased potential for allergic reactions after ethanol exposure.[23] Without further research, we are merely gambling that low-level, long-term ethanol exposure will not increase health hazards.

D. Leaking Fuel Tanks Are Major Sources of MTBE Contamination.

The experience in California is that the overwhelming source of MTBE in groundwater is leaking fuel tanks, and the predominant source of MTBE in surface water is recreational boating. But it is impossible to say that these factors are important or even significant in all regions of the country. Because every area has its own unique geology, and California's soils may be more permeable to petroleum spills and oxygenates than soils with greater organic content, the California experience may be instructive only for areas with similar, permeable soils and/or shallow groundwater supplies used for drinking water.

California has long had a huge number of underground storage tanks, most of which store petroleum products. An inventory in the 1984 revealed over 100,000 underground tanks. The State estimates it has now has over 50,000 operating underground storage tanks – about 6% of the nation's total.[24]

California began efforts to regulate underground tanks in the early 1980s to protect the state's groundwater from solvents and fuels. Since then regulations have required tank owners to obtain permits, test tanks for leaks, and upgrade tanks with new containment and monitoring technology. In 1989 California also established a fund to help underground storage tank owners address leaking tanks[25] by imposing a mill fee on each gallon of petroleum tank owners put in to underground storage.[26] The fee has been increased by subsequent legislation, but in

[22] Froines, op cit., p. 145-146.
[23] Froines, op cit, p. 145-148.
[24] Fogg et al, "Impacts of MTBE on Groundwater," *Health and Environmental Assessment of MTBE, Report to the Legislature of the State of California,* Volume IV: Ground & Surface Water, November 1998, p. 14.
[25] Underground Storage Tank Cleanup Trust Fund Act, SB 299, Keene, 1989.
[26] Wiley, Kip, Senate Office of Research, California Legislature, "Clean Air vs. Clean Water Does California Need MTBE?," February 1998.

light of the new demands on the fund for more costly clean-ups, further increases may be necessary.

As of June 1998, at least 32,779 sites in California were identified as leaking chemical compounds.[27] Ninety percent (90%) – more than twenty-nine thousand leaking California tanks – held petroleum products. In December of 1998 more stringent federal underground storage tanks requirements took effect, which required old and deteriorated tanks to be replaced. The State believes most of the worst leaking tanks were taken out of service. Nevertheless, of the thousands of corroded tanks which contaminated soil nearby, only a small percentage were actively treated to remove contaminants. In most sites involving petroleum products, the chosen remedy was "natural attenuation" – essentially waiting for soil microorganisms to biodegrade the harmful compounds.[28]

As of 1998, 3,486 groundwater sites have been identified with MTBE contamination.[29] Not surprisingly, "MTBE impacts to drinking water wells were similar to benzene impacts given current regulatory action levels."[30] Fortunately, a small percentage of these sites involve high concentrations.

More leaks may threaten ground water, since many "closed sites" – leaking sites no longer under investigation – were not tested for MTBE and were not actively remediated.[31] Leaking underground fuel storage tanks are believed to be the primary source of acute groundwater contamination of MTBE (levels above 20ug/l) in California.[32] Experts say old tank removal may reduce the rate of tank failures in the near future.

But if gasoline contains oxygenates, future gasoline tank leaks involving MTBE appear inevitable. Even new tanks will eventually fail through material aging, operator error, and accident. There are also some reports

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[27] Fogg, et al, "Impacts of MTBE on Groundwater," *Health and Environmental Assessment of MTBE, Report to the Legislature of the State of California*, Volume IV: Ground & Surface Water, November 1998, p. 6.

[28] Fogg, et al, "Impacts of MTBE on Groundwater," *Health and Environmental Assessment of MTBE, Report to the Legislature of the State of California*, Volume IV: Ground & Surface Water, November 1998, p. 57.

[29] Fogg, et al, "Impacts of MTBE on Groundwater," *Health and Environmental Assessment of MTBE, Report to the Legislature of the State of California*, Volume IV: Ground & Surface Water, November 1998, p. 23.

[30] Happel et al, Lawrence Livermore National Laboratory, *An Evaluation of MTBE Impacts to California Groundwater Resources*, report submitted to the California State Water Resources Control Board Underground Storage Tank Program, June 11, 1998, p. 32. Also see Keller et al, stating that the benzene, toluene, xylene and ethylbenzene components of gasoline were found at approximately 50% of leaking fuel sites and MTBE was found at about 49%, "Cost and Performance Evaluation for MTBE-contaminated Water," *Health and Environmental Assessment of MTBE, Report to the Legislature of the State of California*, Volume V, November 1998, p.49.

[31] Fogg et al, in "Impacts of MTBE on Groundwater," *Health and Environmental Assessment of MTBE, Report to the Legislature of the State of California*, Volume IV: Ground & Surface Water, November 1998, p. 28, state that 169 of 186 closed gasoline contaminated sites in Los Angeles had detectable concentrations of MTBE, as did 38 of 65 closed gasoline sites in the Central Valley.

[32] Fogg, op cit., p. 7.

of MTBE + gasoline groundwater contamination from pipeline leaks, above ground fuel tanks failures, and gasoline tanker truck accidents, and these will continue as long as oxygenate use continues.[33]

E. California, and the Nation, Must Swiftly Address Gasoline Contamination Sites.

Chemical properties of oxygenates tend to make gasoline leaks and spills more problematic when they include oxygenates. Ethers and alcohols are highly water soluble and only weakly adsorbed by soil, so these oxygenates move through soil essentially as rapidly as groundwater once they leak or spill. Ethers are resistant to decontamination by soil microorganisms. Alcohols, however, are preferentially consumed by soil microbes relative to conventional gasoline compounds. The consequence, in either case, may be a more persistent, rapidly migrating plume of contaminants, requiring more complex intervention.

Probably at least as problematic as rapid soil migration is the very low odor and taste threshold of ethers, which make water with even minute (parts per billion) quantities of MTBE or other ethers objectionable to most consumers.[34] The positive side of this characteristic is that people will not be inadvertently exposed to drinking water contaminated with even extremely small levels of MTBE contamination - the foul taste will warn anyone away from drinking such water. But this ability to detect trace contamination increases pressure on water agencies concerned about providing acceptable water and worried about treatment costs of reducing any contamination to extremely low levels.

Cleanup of gasoline spills including any oxygenate must be designed to respond to the specific constituents and conditions at the site. Oxygenates may increase the cost of cleanup, with estimates of MTBE clean-up costs vary from 25% to 80% higher than comparable gasoline spills without oxygenates.[35],[36] MTBE and other ethers are persistent in the soil as compared to benzene and other typical gasoline constituents,

[33] Fogg, op cit., pp. 31-34.

[34] Office of Research and Development, United States Environmental Protection Agency, *Oxygenates in Water: Critical Information and Research Needs*, EPA/600/R-98/048, December 1998, p. 20. EPA cites recent studies suggesting that taste and odor thresholds may be even lower for ETBE and TAME than for MTBE.

[35] Kavanaugh, M., Malcolm Pirnie, Inc, "Brief Review of MTBE Fate, Transport, and Remediation," presentation of February 4, 1999, p. 10-11, estimates a 25% increase in treatment costs.

[36] Keller, et al, Cost and Performance Evaluation of Treatment Technologies for MTBE - Contaminated Water, *Health and Environmental Assessment of MTBE, Report to the Legislature of the State of California*, Volume III, November 1998, p. 30 offer an estimated cost increase for treatment of MTBE-contaminated water of from 40% to 80% over treatment of water contaminated with conventional, non-oxygenated gasoline.

and recent evidence about the effectiveness of biodegradation is equivocal.[37]

Early fears that MTBE-contaminated sites could not be remediated now appear excessively pessimistic.[38] However, it appears likely that many MTBE-contaminated sites will persist and migrate with ground water unless active intervention occurs. Although prevention of gasoline spills and leaks must be a national priority, once leaks are identified, remedial action should be swift and complete.

F. Congress Can Help Reduce Contamination by Allowing Reduced Oxygenate Use.

In the last Congress and again in this Congress, Representative Brian Bilbray of San Diego and California Senator Dianne Feinstein introduced bills to allow states to reduce or eliminate oxygenates under certain conditions providing the fuel achieves equivalent or greater emission reductions. This legislation, or legislation which simply eliminates the requirement for minimum percentage of oxygenate in fuels, would be a sound first step at addressing contamination from gasoline spills containing oxygenates, if it were revised to include clear requirements assuring that the air quality benefits of the oxygenate mandate are not lost. Of course, the legislation should also promote more effective gasoline containment and better enforcement of current storage or cleanup requirements. It is however, not realistic to expect any legislative action to eliminate water contamination problems from past or future spills or leaks.

While supporting the goal of minimization of oxygenate use, NRDC has been reluctant to encourage any amendments to the Clean Air Act, and will resist any broad opening of this landmark statute. . If the Bilbray / Feinstein bills, or similar bills designed only to remove the required oxygenate minimum while preserving RFG air quality benefits, can be enacted, we believe this would begin to remedy a serious environmental threat, especially for parts of the country with shallow surface water or highly permeable soils. The problem posed by gasoline spills should trigger further examination and strengthening of federal authority to

[37] Office of Research and Development, United States Environmental Protection Agency, *Oxygenates in Water: Critical Information and Research Needs*, EPA/600/R-98/048, December 1998, p. 10-12

[38] Office of Research and Development, United States Environmental Protection Agency, *Oxygenates in Water: Critical Information and Research Needs*, EPA/600/R-98/048, December 1998, pp. 30-37. Also see Kavanaugh, Malcolm Pirnie, Inc. "Review of the UC SB521 Study: Water Treatment and Remediation Costs," December 1998.

protect and clean water supplies contaminated with petroleum products. But NRDC will continue to vigorously oppose opening the Clean Air Act beyond this narrow issue.

H. NRDC's Recommendations for Addressing Air and Water Quality Concerns Arising from Oxygenate Use:

1) The Federal Reformulated Gasoline Program must preserve all air quality benefits, including the air toxics, ozone precursor, and aromatic reductions, which were required by the Clean Air Act. EPA should ensure that any future changes in RFG (such as changing or reducing oxygenates) do not increase levels of toxics or ozone precursors either in areas using RFG or in the rest of the country using conventional gasoline.

2) Congress can reduce the risk to water supplies from petroleum spills by elimination of the minimum oxygen content requirement in federal reformulated gasoline coupled with clear requirements to fully preserve RFG air quality benefits, including those benefits that flow from the existing oxygenate mandate.

3) Remediation should occur swiftly at sites where gasoline has spilled or leaked Passively awaiting microbiological degradation of gasoline contaminants should not be assumed appropriate for fuel spills or leaks, particularly those threatening water resources. Costs for the cleanup should be recovered from parties responsible for the spills or leaks.

4) Protection of surface water depends on careful regulation of boating (and restrictions on the use of jet skis or other inefficient 2-stroke gasoline engines). Restrictions on numbers of boats, engine types and fueling methods can help to reduce water contamination, and appear necessary regardless of future oxygenate policy.

5) The country needs improved fuel storage tank regulations, including improving siting and monitoring restrictions. Furthermore, enforcement must be strict to ensure recovery of cleanup costs from those responsible for spilling or improperly storing fuel.